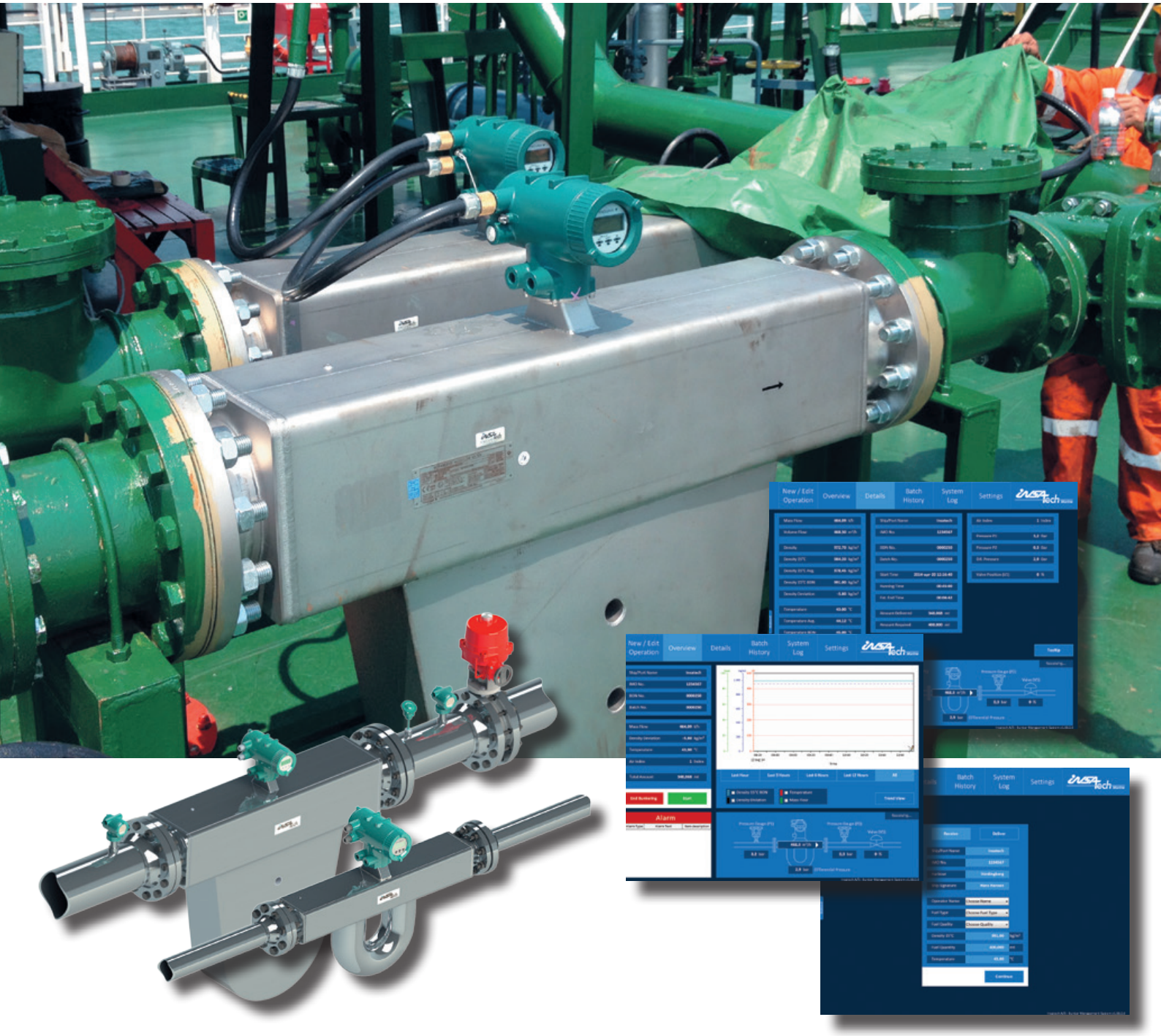
BUNKER MANAGEMENT SYSTEM

Coriolis Mass Flow Measurement for Accurate Validation



www.insatechmarine.com

Taking the guesswork out of it!

GET THE AMOUNT OF FUEL OIL YOU HAVE PAID FOR

In June 2013 the Insatech Bunker Management System documented short-delivery of 53.3 metric tons during a bunker operation. That is equivalent to USD 31,980. For the ship operator this meant that the investment in our system was “paid back” on just one bunker job.

As fuel expenses constitute between 50 pct. and 70 pct. of a ship’s total operational costs, short-deliveries of bunker fuel can easily amount to large extra costs for the ship operator. It is not uncommon that ship operators are short-delivered 3 to 4 pct. during the bunker operation as the volume of the bunker fuel is manipulated by introducing air into the oil. The Insatech Bunker Management System measures and logs mass, temperature and density detecting any attempt to introduce air.

The system is installed on more than 50 vessels world-vide and has been proven in practice during the last six years. It consists of a Coriolis Mass Flow Meter, a computer and an easy-to-use operator interface. In order to obtain thorough knowledge about your fuel consumption, we recommend that you also install our Performance Monitoring System.

THE BUNKER MANAGEMENT SYSTEM

Introduction
As the bunker prices have risen over the last decade, so has the incentive for bunker delivery services to attempt to actively affect the properties of the fuel they deliver. The properties they typically try to manipulate, without stating or informing the recipient, are temperature, air content and composition. The Insatech Marine’s Bunker Management System is developed, designed and constructed to act as a safeguard against these manipulations of bunkered fuel oil.

How It Works
The system consists of a Coriolis mass flow meter, a control cabinet with all the electronics and an operator display. The main component is the Coriolis mass flow meter that measures the temperature and mass directly and therefore is not affected by increase in temperature or air entrained in the oil like volumetric based flow meters. This will ensure you get the bunker you have paid for!

Operation
The operator interface has been designed to be easy to use and after a one-time setup the system is ready for bunkering. The “New Bunkering” functionality will let the operator swiftly enter the necessary information after which the system can be started by pressing one button. After the bunkering operation the system will generate a Bunker Report from the inputted and measured information.

Installation
The installation of the Bunker Management System is mostly done by the ships own crew. Instruments and transmitters are placed on deck in a hazardous zone close to the bunkering outlet. A cabinet containing controls and logging, and the operator interface is placed in a safe zone. Once installed Insatech Marine technicians will do the final wiring connections, commissioning and tests to ensure the system works from the first operation. The system requires minimum maintenance since there are no moving parts.

Service and support
The system requires a minimum of maintenance, as it contains almost no moving parts. Under normal conditions the maintenance of the bunker line on board will suffice. However, if a problem should occur we pride ourselves in our skilled technicians, who will travel the world in order to solve any problems that you might face and with our remote support we can help solve many of the problems from our office as well as adjust the system and perform health checks.

INTRODUCTION

High accuracy inline and real-time measurements
Insatech Marine's Bunker Management System is developed, designed and constructed to act as a safeguard against manipulation of bunkered marine fuel oil as well as counteracting it. By using equipment and methods that deliver high accuracy inline and real-time measurement during bunker operations, any attempt by the bunker service to gain an economic advantage is detected. This ensures you have the upper hand in any possible disputes.

Temperature and air manipulation is detected
As the bunker prices have risen over the last decade, so has the incentive for bunker delivery services to attempt to actively affect the properties of the fuel they deliver. The properties they typically try to manipulate, without stating or informing the recipient, are temperature, air content and composition.

By adjusting the temperature of the fuel oil during bunkering, the bunker service can increase the volume of the oil, and thereby give an impression of a larger delivered quantity, although the weight does not correspond to the bill.

The uncertainty of volume-based measurements
It is common to determine the amount of bunkered fuel oil by measuring the volume of both the fuel tank and the barge bunker tank before and after bunkering and then converting the volume into mass by using conversion tables. This measurement of bunkered oil in volume but settling in weight, causes for some uncertainty due to the table based conversion.

If air is somehow introduced into the Heavy Fuel Oil (HFO) bunker stream the volume will also appear to be bigger than what is actually delivered. The air can enter the HFO during bunkering through several – intended or unintended – entry points. The most common source for air in the bunkered HFO is stripping during the change-over from one source tank to another. As long as it has been agreed how long stripping is allowed it is not an issue. However, if the bunker service provider intentionally uses the stripping period to increase the volume of the delivered fuel oil, it is clearly a manipulation that must be addressed and dealt with.

"The Cappuccino effect"
By letting air seep into the bunker line and thereby continuously manipulating the volume is known as "the cappuccino effect". It causes tiny air bubbles to form that are barely visible and therefor very hard to detect during for example sounding.
Common for both stripping and the cappuccino effect is that the oil will stay aerated for several days even weeks. This means the manipulation is not detected before it is to late to make a dispute since most claim cases should be handed in during the first 48 hours after bunkering.

Measure mass directly – an get the amount of bunker you pay for
The clear advantage of Insatech's Bunker Management System is that it utilizes a coriolis mass flow meter instead of a volumetric flow meter. This means that it measures the mass directly therefore the measurements are not influenced by air entrained in the oil. Furthermore, the system takes the pressure and temperature into account, this means that the system can continuously recalculate the density of the oil depending on the temperature making ensuring that you get the bunker you have paid for.

By understanding the bunker operation and the factors that influence it, applying precise and trustworthy instrumentation and equipment, you will put yourself in the optimum position when it comes to bunkering!

HOW IT WORKS

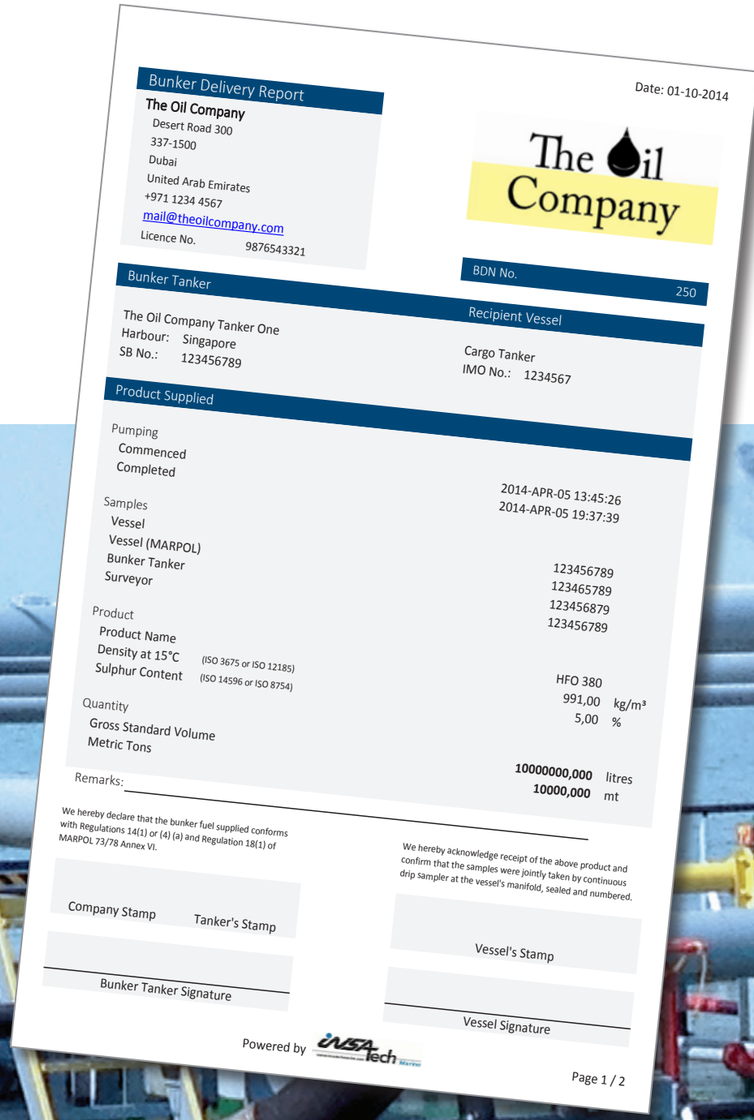
Coriolis mass flow meter measures mass directly
The main component of the Bunker Management System is the mass flow meter based on the Coriolis principle. This flow meter will directly measure the mass of the fluid that passes through it, and is therefore unaffected by any air there might be entrained in the fuel oil. The flow meter is equipped with an internal temperature transmitter which enables automatic compensation for temperature variations during bunkering.

Pressure transmitters ensures heightened precision
Pressure transmitters are placed before and after the flow meter. These pressure transmitters will aid in the regulation of line pressure and flow rate, by controlling a valve placed downstream of the flow meter. This valve is also used for slow start-up, enabling venting of bunker hose and pipes. Furthermore, the two pressure transmitters are needed for the calculation of viscosity and Reynold's number as well as for detection of air in the bunkered fuel oil. If the optional air detection feature is chosen, a separate temperature transmitter will be included for heightened precision.

All signals that are drawn from the above mentioned instruments are received, stored and processed within the control cabinet containing the electronics. All communication is handled and administrated from this cabinet as well.

BDR & CUSTODY TRANSFER

The Bunker Management System from Insatech
Marine is also available in a custody transfer version, with al components complying with OIML (International Organization of Legal Metrology) requirements and thereby also fulfilling the requirements from MPA (Marine Port Authority in Singapore). An MID (Measuring Instruments Directive) approval is under development and expected soon. This way the Bunker Management System will be all that is needed in order to generate and provide a Bunker Delivery Report according to IMO requirements and standards.


Bunker Delivery Report

Date: 01-10-2014

The Oil Company
Desert Road 300
337-1500
Dubai
United Arab Emirates
+971 1234 4567
mail@theoilcompany.com
Licence No. 9876543321

BDN No. 250

Bunker Tanker
The Oil Company Tanker One
Harbour: Singapore
SB No.: 123456789

Recipient Vessel
Cargo Tanker
IMO No.: 1234567

Product Supplied

Pumping	
Commenced	2014-APR-05 13:45:26
Completed	2014-APR-05 19:37:39
Samples	
Vessel	123456789
Vessel (MARPOL)	123465789
Bunker Tanker	123456879
Surveyor	123456789
Product	
Product Name	HFO 380
Density at 15°C (ISO 3675 or ISO 12185)	991,00 kg/m³
Sulphur Content (ISO 14596 or ISO 8754)	5,00 %
Quantity	
Gross Standard Volume	10000000,000 litres
Metric Tons	10000,000 mt

Remarks:

We hereby declare that the bunker fuel supplied conforms with Regulations 14(1) or (4) (a) and Regulation 18(1) of MARPOL 73/78 Annex VI.

We hereby acknowledge receipt of the above product and confirm that the samples were jointly taken by continuous drip sampler at the vessel's manifold, sealed and numbered.

Company Stamp Tanker's Stamp

Vessel's Stamp

Bunker Tanker Signature

Vessel Signature

Powered by

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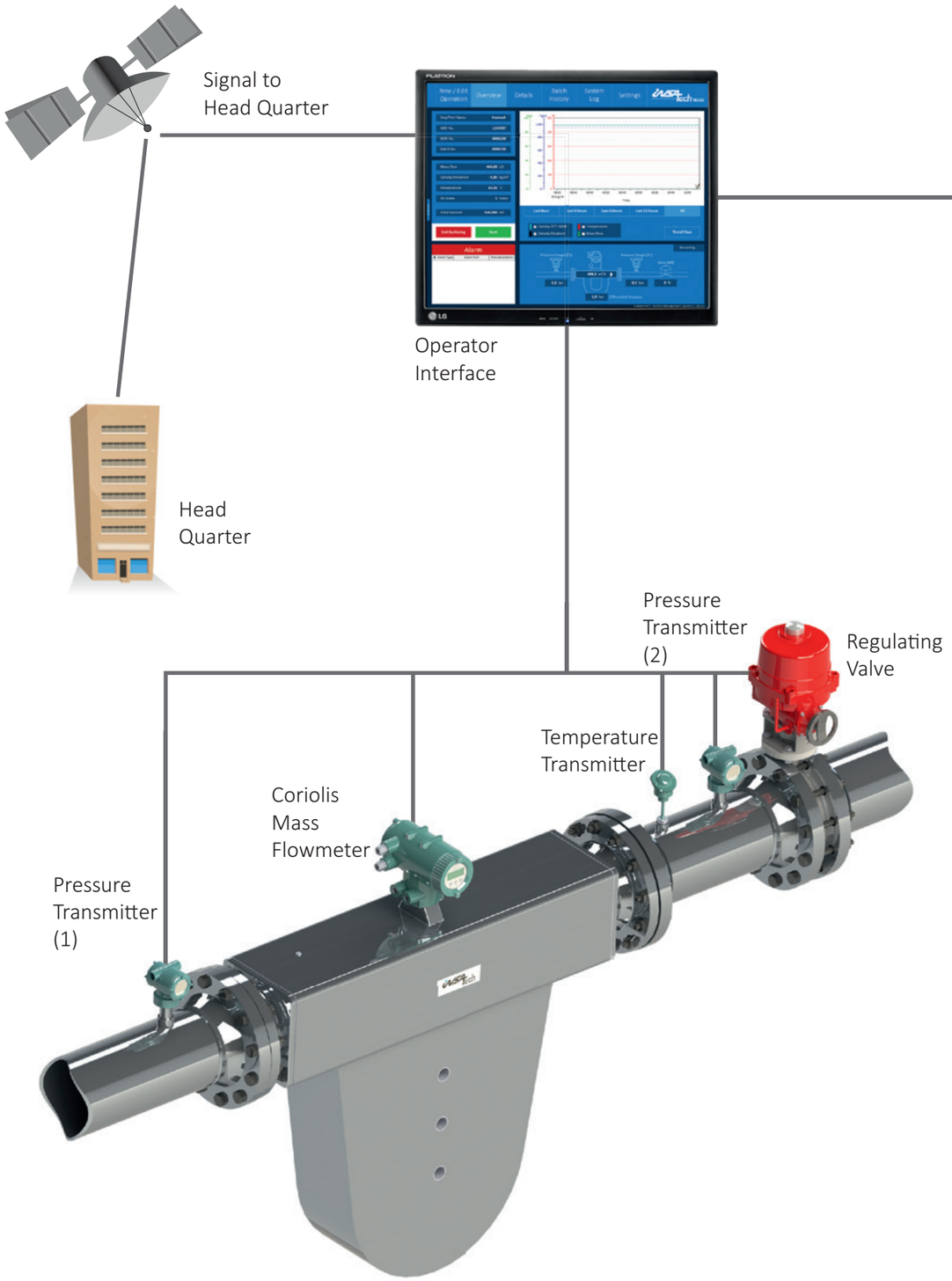
OVERVIEW



New / Edit Operation
The screen is the first you will encounter when you begin a new bunkering. You will be able to easily input information needed beginning a new bunkering for example ship name, IMO number, density of the fuel oil at 15 degrees (density15). The Bunker Management System can be used both when delivering and receiving fuel oil.

Overview
The overview screen gives you an overview of the oil transfer, with the most needed information. The trend will give you an easy view of the oil transfer where you will be able to see if any problems occur. At the bottom you have an alarm window as well as a system overview, showing information about pressure, flow and valve opening.

Trend View
The trend view gives you a more extensive view of your trends making it easier to see subtle changes it also has more trends available. The different trends can easily be turned on or off showing only the relevant data you want.

Details
The screen gives you all the bunker data in great detail. You will see bunker data on the left, such as density and temperature, batch data in the middle such as estimated end time and amount delivered, and system data on the right such as pressure and air index.

Settings
In the settings screen you enter the basic information about the ship/barge and company. You will also be able to easily add new operators and fuel types to the system. When entered they will be available on the New / Edit bunkering screen for quick selection. The data will also be used for the Bunker Delivery Note.

OPERATION

A system that is simple to operate
Insatech Marine has developed and designed the operator interface in-house with functionality and easy operation as main focus. We believe it is vital to have a system that is easy to use in order to optimize the benefits of it. By minimizing the possible challenges there might be in the operation of the equipment as well as by easing the processes related to any arising protests and claims from bunker recipient we have developed and easy to use system.

Simple operation of the Bunker Management System is achieved by a clean and minimalistic design, that eliminates confusing elements and unnecessary information, while in depth and full data is still readily available to any user. All without compromising the compatibility and regulatory requirements of the system, which Insatech Marine always seeks to meet and exceed.

One-time setup
When the system has been installed and is ready for use some basic information needs to be entered for future operational purposes. Once the ship's name, IMO number and other obligatory data has been entered, the system will use these for bunker reports and displays.

User experience
When using the Insatech Marine Bunker Management System all information is readily available within one touch of the screen. All information that is needed during bunkering operations is presented in the overview display, including intuitive illustrations of current status within the different stages of the system.
When starting a new bunker delivery, the "New Operation" display will swiftly let the operator enter the necessary input and ready the Bunker Management System for the task at hand. Once the data has been entered, the operation is ready to begin, and by the press of one button the system is activated. During the operation the operator will be able to see information such as flow, density, viscosity and trends.
After the operation all details regarding the bunkering will be saved in a Bunker Report (PDF), which can then be printed or send to another destination via email.

PRODUCT VARIATIONS

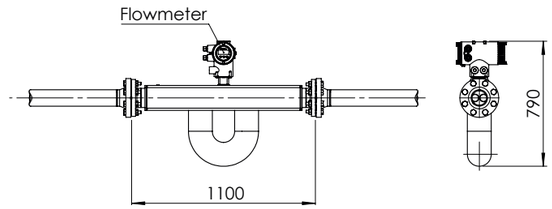
As different owners, charters and operators have different requirements and needs, Insatech Marine Bunker Management System is manufactured in just as many different variations, all according to the needed and requested properties. The chart table below describes the product code syntax of the variations.

Model	Suffix Code	Description	Comments
BMS		Bunker Management System	
System	-B	Bunker Ship	
	-R	Receiving Vessel	
Control Cabinet	S	Powder coated aluminium 500x500mm	
	L	Powder coated aluminium 760x760mm	Used with option /OI
	N	Not Selected	Only with Insatech Performance Management System
Explosion proof	-N	Non Ex	
	EX	Ex	Control cabinet in Safe Area
Converter - Type	C	Flowmeter mounted	
	R	Mounted in Control Cabinet	Only special applications, consult Insatech
Flow meter size	-T38	RCCT38	
	-T39	RCCT39	
	-T39IR	RCCT39IR	
	-T39XR	RCCT39XR	
	-S38	RCCS38	
	-S39	RCCS39	
	-S39IR	RCCS39IR	
	-S39XR	RCCS39XR	
Flow meter size 2nd. Meter	-N	Not Selected	
	-T38	RCCT38	
	-T39	RCCT39	
	-T39IR	RCCT39IR	
	-T39XR	RCCT39XR	
	-S38	RCCS38	
	-S39	RCCS39	
	-S39IR	RCCS39IR	
	-S39XR	RCCS39XR	
Flow meter size 3rd. Meter	-N	Not Selected	
	-T38	RCCT38	
	-T39	RCCT39	
	-T39IR	RCCT39IR	
	-T39XR	RCCT39XR	
	-S38	RCCS38	
	-S39	RCCS39	
	-S39IR	RCCS39IR	
	-S39XR	RCCS39XR	
Operator Interface	T	Touch screen 17"	For panel mount
	S	Standard 17" screen	Incl. Mouse & Keybord
	N	Not Selected	Only with Insatech Performance Management System
Bunker Report	ST	Standard acc. Insatech Layout	
	CS	Customer Specific	Price on request
Pressure Transmitters	PT	Two pressure transmitters	
	-N	Not Selected	Only special applications, consult Insatech
Temperatur transmitter	/TT	1 x Temperatur transmitter	Additionel sensor for increased accuracy
	-N	Note Selected	
Air Detection System	/Y	Advanced Air Detection System	Not without option /TT & /RV
	-N	Not Selected	
Regulating Valve	/RV	Regulating Valve	Not without option /Y & /TT
	-N	Not Selected	
Two product system	-N	Not Selected	
	/TP	Two seperate lines with commen Interface	Used for two seperate product lines (MGO/HFO)
OIML R117-1 compliancy	-N	Not Selected	
	/OI	Yes	OIML R117-1 Compliant system (Only system-B)
Special Options	-N	Not Selected	
	/Z	Special options	Option for special functions

DRAWINGS

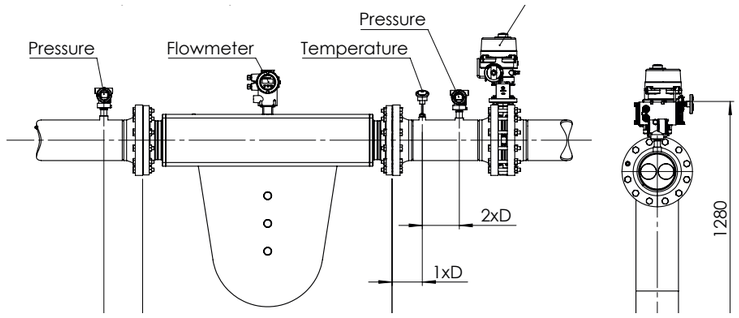
RCCT39IR (4”ANSI 150#)

Pressure	MGO	HFO 180 cSt	HFO 380 cSt	HFO 500 cSt
2 bar	245 t/h	150 t/h	135 t/h	125 t/h
4 bar	300 t/h	235 t/h	195 t/h	180 t/h
6 bar	300 t/h	295 t/h	250 t/h	230 t/h



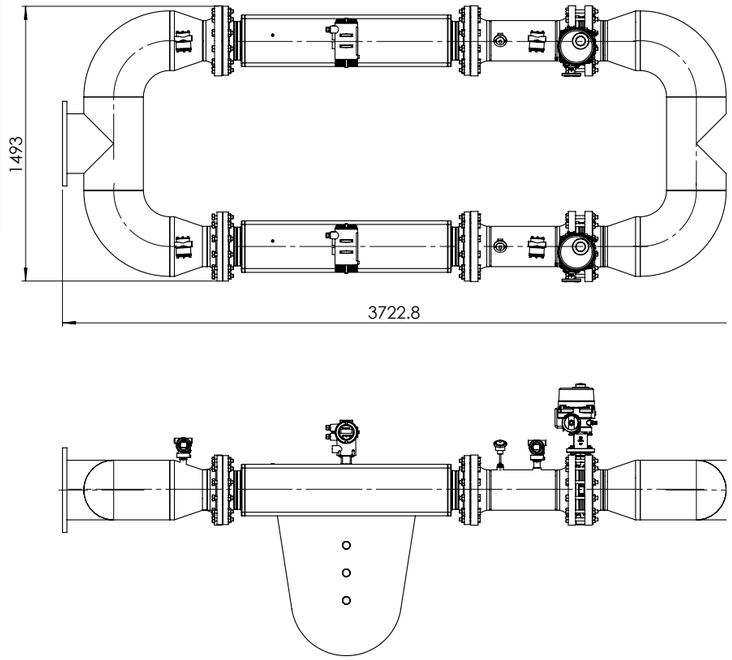
RCCT39XR (DN200/PN40)

Pressure	MGO	HFO 180 cSt	HFO 380 cSt	HFO 500 cSt
2 bar	510 t/h	260 t/h	220 t/h	210 t/h
4 bar	600 t/h	365 t/h	310 t/h	295 t/h
6 bar	600 t/h	455 t/h	390 t/h	370 t/h



2 x RCCT39XR (DN200/PN40)

Pressure	MGO	HFO 180 cSt	HFO 380 cSt	HFO 500 cSt
2 bar	1020 t/h	520 t/h	440 t/h	420 t/h
4 bar	1200 t/h	730 t/h	620 t/h	590 t/h
6 bar	1200 t/h	910 t/h	780 t/h	740 t/h



Above figures are guidelines – Special pipe design for bunker piping can have influence on actual figures.

INSTALLATION

Insatech Marine provides you with turnkey solutions
A typical installation of an Insatech Marine Bunker Management System is mainly done by the ships own crew. The instruments and transmitters are most commonly placed on deck (in a hazardous zone), as close to the bunker outlet as possible, while the cabinet containing the controls and logging is placed in safe zone. The necessary wiring is drawn and prepared from the cabinet to the measurement equipment. Once everything is in place, Insatech Marine will send their technicians to do the final wiring connections and run tests and commissioning to ensure the functionality of the installation from first operation. Based on consultancies and exchange of information, Insatech will ensure the fit of the system on board, and all components will have been on Insatech Marine's facilities for setup and check. The Bunker Management System can optionally be fitted with piping containing the required connections for all transmitters in order to ease the installation as much as possible.

SERVICE, MAINTENANCE & SUPPORT

Minimal maintenance required
The Insatech Marine Bunker Management System requires a minimum of maintenance, as it contains almost no moving parts. Under normal conditions the maintenance of the bunker line on board will suffice. A specific maintenance guide will be included in the user manual delivered with the Bunker Management System.
At Insatech Marine, we pride ourselves in our skilled technicians, and with our global services we are able to solve any issues there might arise, should we not be able to solve them by remote support. On operators request our programmers can remotely access to the system, and help with adjustments or perform health checks.

Service and support is readily accessible
As a part of our services, we can aid in assuring successful re-certifications of the system in order to make sure that the installed equipment is always working and fulfilling all regulatory requirements put up by local authorities and notified bodies.
Once you have chosen the Insatech Marine Bunker Management System, our technicians are also able to do training of the crew on board – both as a part of the commissioning but also on a regular basis with a frequency set by your needs and wishes.

A TRUSTWORTHY & COMPETENT PARTNER

Insatech Marine offer field-tested and proven solutions that meet international rules and regulations as well as helping you save money. We provide comprehensive installation, commissioning, training, service and maintenance, which ensure as little downtime as possible.
Insatech was established in 1989 by Alan Christoffersen, who is still CEO. Since then it has grown to more than 70 employees. With 25 years of experience in the field of automation and instrumentation we are a strong partner for both our customers and suppliers. As a result of our longstanding partnerships with some of the world's leading manufacturers within instrumentation and automation, we are able to provide you with global service.

WHAT WE DO

Bunker Management Systems
A Coriolis Mass Flow Meter-based Bunker Management System with a highly accurate and volume insensitive measurement of transferred bunker. The system ensures an efficient bunker operation where you get the amount of bunker you pay for.

Fuel Consumption System
The system works by installing high accuracy mass flow meters before and after consumers, for example the main engine and generators, giving an overview of instant fuel consumption and total fuel consumption over time. This information is a useful and money-saving tool used in the decision process on the bridge.

Performance Management Systems
The system provides an overview of the ships performance based on direct on-line measurements. It is versatile and can be customized according to any measurements that you would like to monitor.
Fuel consumption is measured with high accuracy mass flow meters, together with propeller shaft torque and rpm. For generators a power meter will be installed. This gives valuable information about fuel consumption, but also KPI values (Key Performance Indicator) as g/kWh & g/Nm.

ODME Systems/15 PPM Bilge Alarm
By regulations under MARPOL, all vessels must be equipped with a system for Bilge Water Discharge Monitoring as well as Oil Discharge Monitoring and Control Equipment (ODME). Both systems monitor the oil content of over board discharged water from the bilge and the ballast tanks and controls the discharge allowance based on whether the level of oil content is below the set limits.

S3 Smart Sulphur Fuel Switch
The S3 can manage, control and log the entire changeover process from HFO to MGO/MDO or vice versa when entering or leaving an ECA. The S3 has real-time display and logging of sulphur levels as a built-in function. Furthermore, it can be combined with the scrubber on-board and help optimize its performance.

Cargo Management Systems
InsaCargo is a very flexible cargo and ballast management system which is ideal for retrofitting of either full or partial systems on board vessels. By using only known and proven suppliers with global service and marine experience and approvals, InsaCargo ensures very low down-time risk and high performance.

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